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50X1

EVALUATION SUMMARY

PRELIMINARY ENGINEERING MODEL

PROJECT TAILOR TRANSMITTER

(A-1, 0.5 Watt Modules)

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DATE: 20 December 1957

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1. INTRODUCTION

This report summarizes an evaluation of a preliminary engineering model of an RF transmitter developed under Project Tailor. The unit consists of four modular subassemblies designed to transmit in the A-1 mode at an output of 0.5 watts. The transmitter is part of a project under development by [redacted]. Although the evaluation request indicated that the primary interest at this time was in determining VHF suppression and spurious emission characteristics, several additional important characteristics were also checked. 50X1 50X1

The transmitter consists of four cubical copper boxes with interconnecting RF cables and power wires. The outside dimensions of the boxes vary from approximately 1-1/2 to 2 inches. The units are clip-mounted and are arranged collinearly on a 12 x 4 x 1/4 inch brass base. All tuning controls and terminals protrude beyond the box dimensions given above.

The four modules contain the electrical circuitry required to assemble a small 3 to 6 mc transmitter. The transmitter is essentially composed of a series mode crystal controlled RF oscillator, a key and side tone oscillator, an amplifier, and an antenna coupler. The oscillators are transistorized and the amplifier is of the vacuum tube type.

The input power to the units is obtained from an external 12 volt DC supply and a 150 volt DC supply. Areas in which the performance of the transmitter is considered unsatisfactory are noted in the test results, conclusions and recommendations set forth in the following paragraphs.

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2. SUMMARY OF TEST DATA

2.1. RF Power Output

	Power Output (Watts)	Dummy Load (Ohms)	Frequency (MC)
Average	0.78	76 - 1300	3 - 6
Maximum	0.95	1300	4
Minimum	0.51	76	6

Specification: The RF power available at the antenna terminals shall be not less than 0.5 watt. The power shall remain essentially constant at all frequencies and temperatures.

2.2. RF Crystal Current

	Crystal Current (MA)	Crystal Drive (MW)	Frequency (MC)
Average	27	7.3	3 - 6
Maximum	36	10.7	6
Minimum	5	0.2	3

Specification: The crystal drive shall be not greater than 10 milliwatts.

2.3. VHF Radiation

No evidence of television interference was noted.

Specification: The RF power shall not exceed 1000 micromicrowatts at any frequency above 50 megacycles.

2.4. Key Click Radiation

	Quasi-Peak Intensity (uv/m)	Frequency (mc)
Average	80	0.15 - 3
Maximum	140	0.15
Minimum	50	3
	Negligible	5 - 25

Specification: The key click radiation shall be less than 500 microvolts per meter at all frequencies.

2.5. Spurious Radiation

No evidence of spurious or self oscillation was noted.

Specification: No spurious radiation shall be permissible, except harmonics, over the frequency range from 15 kc to 220 mc.

2.6. Harmonic Radiation

	Attenuation Below the Fundamental (db)				Frequency (mc)
	2nd	3rd	4th	5th	
Average	35	40	42	50	3 - 6
Maximum	42	42	50	53	3
Minimum	30	30	34	40	6

Specification: The second harmonic shall be down at least 25 db. The third harmonic shall be down at least 40 db. The fourth and higher order harmonics shall be down at least 60 db.

2.7. Case Radiation

	Cast Radiation Distance - 3 Feet (u volts)	Frequency (mc)
Average	1160	3 - 6
Maximum	1900	5
Minimum	550	3

Specification: No specification given.

2.8. Keyed Wave Form

The keyed wave form appears to be conventional.

Specification: The envelope of the keyed wave shall possess rounded corners on the leading and trailing edges and have no sharp peaks nor abrupt transients. The observed signal shall be free from backwave and chirping over the entire range of the equipment.

2.9. Power Requirement

The input power requirement was measured to be 36 milliamperes at 150 volts DC (5.4 watts) and 460 milliamperes at 12 volts DC (5.5 watts).

3. CONCLUSIONS

The preliminary engineering model of the RF modular subassemblies demonstrates a novel method of radio transmitter packaging. It also indicates the feasibility of obtaining considerable choice and flexibility of assembly with respect to transmitter size, physical arrangement, emission, and transport technique. However, the evaluation of the units reveal that they have shortcomings in areas of both physical and electrical design. A list of the apparent shortcomings follows:

(1) The RF oscillator radiates excessively in both key-up and key-down positions.

(2) The third and higher order harmonics radiates excessively.

(3) The RF amplifier tuning control is critical to adjust at the high end of the band.

(4) The tuning indicator of the RF amplifier requires a DC meter for indicating purposes.

(5) The tuning controls of the modules are difficult to manipulate.

(6) The antenna coupler is complex and is not provided with a tuning indicator.

(7) The modules are inadequately secured to the mounting base board.

(8) The key lacks smoothness in its operation because of a complex mechanical design. The key housing is not adequately shielded against dust and foreign material.

(9) The module covers are inadequately secured.

(10) The size of the antenna post is out of proportion to the module size.

(11) Wasted space is noted in some module boxes.

(12) The 150 volts B plus cannot be conveniently obtained for battery operation.

(13) The efficiency of the RF amplifier is low. Operating parameters indicate that this stage is operating class A.

(14) The module chassis should be provided with a rigid ground terminal.

It is believed that this version of the RF modular transmitter equipment will not withstand the rough usage required in the field.

4. RECOMMENDATIONS

The modules submitted for evaluation show promise; however, the following recommendations are submitted with the view to further performance improvement.

(1) If the case radiation can not be suppressed to a reasonable level, both the RF oscillator and amplifier stages should be keyed.

(2) The harmonic radiation from the assembly should be reduced. It is believed that if the case radiation could be reduced considerably, the harmonic radiation likewise would decrease, because much of the harmonic energy radiates directly from the modular assembly cases.

(3) The key should be redesigned.

(4) The criticalness of the RF amplifier tank tuning control should be eliminated. It is doubtful if slug tuning will ever prove entirely satisfactory with the present mechanical setup.

(5) The RF amplifier stage should be designed with higher efficiency and around plate voltage which could be supplied with available "B" battery voltages. For battery operation it is important that the amplifier efficiency be made as high as possible.

(6) The resonance indicator for the RF amplifier tank should be modified to eliminate the use of an external DC meter.

(7) The tuning controls of the unit should be easier to manipulate and should be recessed.

(8) The covers on the modules should be mechanically secured to minimize RF leakage.

(9) Each module case should be provided with a rigid ground terminal.

(10) An antenna tuning indicator should be provided.

(11) The tuning control switches should be provided with rotation limit markings to prevent twist breakage.